

WHAT IS CLAIMED:

1. A thermally conductive paste comprising porous agglomerates of carbon particles dispersed in a paste-forming vehicle.
2. The paste as claimed in claim 1, wherein the porous agglomerates of carbon particles comprise a carbon black.
3. The paste as claimed in claim 1, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solvent selected from the group consisting of silicates, glycol ethers, methoxypolyethylene glycol ("MPEG"), ethylene glycol, propylene glycol, ethylene oxide, propylene oxide, polyethylene glycol ("PEG"), PEG modified with various types of functional groups at the ends of a macromolecular chain, oil, water, alcohols, diethyl sulfate, diisobutyl carbinol, diisobutyl ketone, hexylene glycol, isobutyl acetate, isophorone, isopropyl acetate, methyl isobutyl carbinol, ketone, *n*-butyl acetate, *n*-propyl acetate, primary amyl acetate mixed isomers, primary amyl alcohol mixed isomers, *n*-propyl propionate, *n*-butyl propionate, *n*-pentyl propionate, methylene chloride, perchloroethylene, trichloroethylene, xylene, acetone, ethyl acetate, and chemically related substances.
4. The paste as claimed in claim 1, wherein the solvent is an organic solvent.
5. The paste as claimed in claim 4, wherein the solvent is polyethylene glycol.
6. The paste as claimed in claim 1, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solute selected from the group consisting of cellulosic resin, thermoplastic resin, glycidyl methacrylate, hydroxy(meth)acrylate monomers, epsilon-caprolactone monomer, hydroxypropyl acrylate, hydroxyethyl acrylate, ethylene acrylic acid, divinylbenzene, styrene-butadiene latexes, acrylic latexes, vinyl acrylic latexes, styrene acrylic latexes, vinyl versatate latexes, vinyl chloride, vinylbenzyl chloride, chloromethylstyrene, vinyl acetate copolymers, epoxy resins, epoxy

acrylate, aminoethylethanolamine, glycol ethers, propylene glycols, ethylene glycols, polyols, ethylene acrylic acid resins, methylcellulose, ethyl cellulose, hydroxyethyl cellulose, polyvinyl alcohol, starch, and chemically related substances.

7. The paste as claimed in claim 5, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

8. The paste as claimed in claim 7, wherein the amount of ethyl cellulose present in the paste is in the range of about 3 to about 5 vol.%.

9. The paste as claimed in claim 8, wherein the amount of ethyl cellulose present in the paste is about 3 vol.%.

10. The paste as claimed in claim 7, wherein the amount of carbon particles dispersed in the paste is less than about 2 vol.%.

11. The paste as claimed in claim 10, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

12. The paste as claimed in claim 9, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

13. The paste as claimed in claim 12, wherein the amount of carbon particles dispersed in the paste is about 1.25 vol.%.

14. The paste as claimed in claim 13, wherein the porous agglomerates of carbon particles comprise a carbon black.

15. The paste as claimed in claim 4, wherein the solvent is di(ethylene glycol) butyl ether.

16. The paste as claimed in claim 15, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

17. The paste as claimed in claim 16, wherein the amount of ethyl cellulose present in the paste is about 40 vol.%.

18. The paste as claimed in claim 16, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

19. The paste as claimed in claim 17, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

20. The paste as claimed in claim 19, wherein the amount of carbon particles dispersed in the paste is about 0.20 vol.%.

21. The paste as claimed in claim 20, wherein the porous agglomerates of carbon particles comprise a carbon black.

22. A thermally conductive interface material comprising the paste as claimed in claim 1.

23. A thermally conductive interface material comprising the paste as claimed in claim 14.

24. A thermally conductive interface material comprising the paste as claimed in claim 21.

25. An apparatus comprising:
a heat source;
a heat sink for removing heat from the heat source; and
a layer of a thermally conductive paste disposed between and in contact with the heat source and the heat sink, the paste comprising porous agglomerates of carbon particles dispersed in a paste-forming vehicle.

26. The apparatus as claimed in claim 25, wherein the porous agglomerates of carbon particles comprise a carbon black.

27. The apparatus as claimed in claim 25, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solvent selected from the group consisting of silicates, glycol ethers, methoxypolyethylene glycol ("MPEG"), ethylene glycol, propylene glycol, ethylene oxide, propylene oxide, polyethylene glycol ("PEG"), PEG modified with various types of functional groups at the ends of a macromolecular chain, oil, water, alcohols, diethyl sulfate, diisobutyl carbinol, diisobutyl ketone, hexylene glycol, isobutyl acetate, isophorone, isopropyl acetate, methyl isobutyl carbinol, ketone, *n*-butyl acetate, *n*-propyl acetate, primary amyl acetate mixed isomers, primary amyl alcohol mixed isomers, *n*-propyl propionate, *n*-butyl propionate, *n*-pentyl propionate, methylene chloride, perchloroethylene, trichloroethylene, xylene, acetone, ethyl acetate, and chemically related substances.

28. The apparatus as claimed in claim 25, wherein the solvent is an organic solvent.

29. The apparatus as claimed in claim 28, wherein the solvent is polyethylene glycol.

30. The apparatus as claimed in claim 25, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solute selected from the group consisting of cellulosic resin, thermoplastic resin, glycidyl methacrylate, hydroxy(meth)acrylate monomers, epsilon-caprolactone monomer, hydroxypropyl acrylate, hydroxyethyl acrylate, ethylene acrylic acid, divinylbenzene, styrene-butadiene latexes, acrylic latexes, vinyl acrylic latexes, styrene acrylic latexes, vinyl versatate latexes, vinyl chloride, vinylbenzyl chloride, chloromethylstyrene, vinyl acetate copolymers, epoxy resins, epoxy acrylate, aminoethylethanolamine, glycol ethers, propylene glycols, ethylene glycols, polyols, ethylene acrylic acid resins, methylcellulose, ethyl cellulose, hydroxyethyl cellulose, polyvinyl alcohol, starch, and chemically related substances.

31. The apparatus as claimed in claim 29, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

32. The apparatus as claimed in claim 31, wherein the amount of ethyl cellulose present in the paste is in the range of about 3 to about 5 vol.%.

33. The apparatus as claimed in claim 32, wherein the amount of ethyl cellulose present in the paste is about 3 vol.%.

34. The apparatus as claimed in claim 31, wherein the amount of carbon particles dispersed in the paste is less than about 2 vol.%.

35. The apparatus as claimed in claim 34, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

36. The apparatus as claimed in claim 33, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

37. The apparatus as claimed in claim 36, wherein the amount of carbon particles dispersed in the paste is about 1.25 vol.%.

38. The apparatus as claimed in claim 37, wherein the porous agglomerates of carbon particles comprise a carbon black.

39. The apparatus as claimed in claim 28, wherein the solvent is di(ethylene glycol).

40. The apparatus as claimed in claim 39, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

41. The apparatus as claimed in claim 40, wherein the amount of ethyl cellulose present in the paste is about 40 vol.%.

42. The apparatus as claimed in claim 40, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

43. The apparatus as claimed in claim 41, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

44. The apparatus as claimed in claim 43, wherein the amount of carbon particles dispersed in the paste is about 0.20 vol.%.

45. The apparatus as claimed in claim 44, wherein the porous agglomerates of carbon particles comprise a carbon black.

46. A method of removing heat from a heat source comprising:
providing a heat sink proximate the heat source and
disposing a layer of a thermally conductive paste between and in contact with the heat source and the heat sink, the paste comprising porous agglomerates of carbon particles dispersed in a paste-forming vehicle.

47. The method as claimed in claim 46, wherein the porous agglomerates of carbon particles comprise a carbon black.

48. The method as claimed in claim 46, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solvent selected from the group consisting of silicates, glycol ethers, methoxypolyethylene glycol ("MPEG"), ethylene glycol, propylene glycol, ethylene oxide, propylene oxide, polyethylene glycol ("PEG"), PEG modified with various types of functional groups at the ends of a macromolecular chain, oil, water, alcohols, diethyl sulfate, diisobutyl carbinol, diisobutyl ketone, hexylene glycol, isobutyl acetate, isophorone, isopropyl acetate, methyl isobutyl carbinol, ketone, *n*-butyl acetate, *n*-propyl acetate, primary amyl acetate mixed isomers, primary amyl alcohol mixed isomers, *n*-propyl propionate, *n*-butyl propionate, *n*-pentyl propionate, methylene chloride, perchloroethylene, trichloroethylene, xylene, acetone, ethyl acetate, and chemically related substances.

49. The method as claimed in claim 46, wherein the solvent is an organic solvent.

50. The method as claimed in claim 49, wherein the solvent is polyethylene glycol.

51. The method as claimed in claim 46, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solute selected from the group consisting of cellulosic resin, thermoplastic resin, glycidyl methacrylate, hydroxy(meth)acrylate monomers, epsilon-caprolactone monomer, hydroxypropyl acrylate, hydroxyethyl acrylate, ethylene acrylic acid, divinylbenzene, styrene-butadiene latexes, acrylic latexes, vinyl acrylic latexes, styrene acrylic latexes, vinyl versatate latexes, vinyl chloride, vinylbenzyl chloride, chloromethylstyrene, vinyl acetate copolymers, epoxy resins, epoxy acrylate, aminoethylethanolamine, glycol ethers, propylene glycols, ethylene glycols, polyols, ethylene acrylic acid resins, methylcellulose, ethyl cellulose, hydroxyethyl cellulose, polyvinyl alcohol, starch, and chemically related substances.

52. The method as claimed in claim 50, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

53. The method as claimed in claim 52, wherein the amount of ethyl cellulose present in the paste is in the range of about 3 to about 5 vol.%.

54. The method as claimed in claim 53, wherein the amount of ethyl cellulose present in the paste is about 3 vol.%.

55. The method as claimed in claim 52, wherein the amount of carbon particles dispersed in the paste is less than about 2 vol.%.

56. The method as claimed in claim 55, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

57. The method as claimed in claim 54, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

58. The method as claimed in claim 57, wherein the amount of carbon particles dispersed in the paste is about 1.25 vol.%.

59. The method as claimed in claim 58, wherein the porous agglomerates of carbon particles comprise a carbon black.

60. The method as claimed in claim 49, wherein the solvent is di(ethylene glycol) butyl ether.

61. The method as claimed in claim 60, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

62. The method as claimed in claim 61, wherein the amount of ethyl cellulose present in the paste is about 40 vol.%.

63. The method as claimed in claim 61, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

64. The method as claimed in claim 62, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

65. The method as claimed in claim 64, wherein the amount of carbon particles dispersed in the paste is about 0.20 vol.%.

66. The method as claimed in claim 65, wherein the porous agglomerates of carbon particles comprise a carbon black.

67. A method of improving a thermal contact between a first object and a second object proximate the first object, comprising disposing a layer of a thermally conductive paste between and in contact with the first object and the second object, the

paste comprising porous agglomerates of carbon particles dispersed in a paste-forming vehicle.

68. The method as claimed in claim 67, wherein the first object is a heat source.

69. The method as claimed in claim 67, wherein the first object is a cold source.

70. The method as claimed in claim 67, wherein the porous agglomerates of carbon particles comprise a carbon black.

71. The method as claimed in claim 67, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solvent selected from the group consisting of silicates, glycol ethers, methoxypolyethylene glycol ("MPEG"), ethylene glycol, propylene glycol, ethylene oxide, propylene oxide, polyethylene glycol ("PEG"), PEG modified with various types of functional groups at the ends of a macromolecular chain, oil, water, alcohols, diethyl sulfate, diisobutyl carbinol, diisobutyl ketone, hexylene glycol, isobutyl acetate, isophorone, isopropyl acetate, methyl isobutyl carbinol, ketone, *n*-butyl acetate, *n*-propyl acetate, primary amyl acetate mixed isomers, primary amyl alcohol mixed isomers, *n*-propyl propionate, *n*-butyl propionate, *n*-pentyl propionate, methylene chloride, perchloroethylene, trichloroethylene, xylene, acetone, ethyl acetate, and chemically related substances.

72. The method as claimed in claim 67, wherein the solvent is an organic solvent.

73. The method as claimed in claim 72, wherein the solvent is polyethylene glycol.

74. The method as claimed in claim 67, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solute selected from the group consisting of cellulosic resin, thermoplastic resin, glycidyl methacrylate,

hydroxy(meth)acrylate monomers, epsilon-caprolactone monomer, hydroxypropyl acrylate, hydroxyethyl acrylate, ethylene acrylic acid, divinylbenzene, styrene-butadiene latexes, acrylic latexes, vinyl acrylic latexes, styrene acrylic latexes, vinyl versatate latexes, vinyl chloride, vinylbenzyl chloride, chloromethylstyrene, vinyl acetate copolymers, epoxy resins, epoxy acrylate, aminoethylethanolamine, glycol ethers, propylene glycols, ethylene glycols, polyols, ethylene acrylic acid resins, methylcellulose, ethyl cellulose, hydroxyethyl cellulose, polyvinyl alcohol, starch, and chemically related substances.

75. The method as claimed in claim 73, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

76. The method as claimed in claim 75, wherein the amount of ethyl cellulose present in the paste is in the range of about 3 to about 5 vol.%.

77. The method as claimed in claim 76, wherein the amount of ethyl cellulose present in the paste is about 3 vol.%.

78. The method as claimed in claim 75, wherein the amount of carbon particles dispersed in the paste is less than about 2 vol.%.

79. The method as claimed in claim 78, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

80. The method as claimed in claim 77, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

81. The method as claimed in claim 80, wherein the amount of carbon particles dispersed in the paste is about 1.25 vol.%.

82. The method as claimed in claim 81, wherein the porous agglomerates of carbon particles comprise a carbon black.

83. The method as claimed in claim 72, wherein the solvent is di(ethylene glycol) butyl ether.

84. The method as claimed in claim 83, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

85. The method as claimed in claim 84, wherein the amount of ethyl cellulose present in the paste is about 40 vol.%.

86. The method as claimed in claim 84, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

87. The method as claimed in claim 85, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

88. The method as claimed in claim 87, wherein the amount of carbon particles dispersed in the paste is about 0.20 vol.%.

89. The method as claimed in claim 88, wherein the porous agglomerates of carbon particles comprise a carbon black.

90. An apparatus comprising:
a cold source;
an object proximate the cold source; and
a layer of a thermally conductive paste disposed between and in contact with the cold source and the object, the paste comprising porous agglomerates of carbon particles dispersed in a paste-forming vehicle.

91. The apparatus as claimed in claim 90, wherein the porous agglomerates of carbon particles comprise a carbon black.

92. The apparatus as claimed in claim 90, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solvent selected from the group

consisting of silicates, glycol ethers, methoxypolyethylene glycol ("MPEG"), ethylene glycol, propylene glycol, ethylene oxide, propylene oxide, polyethylene glycol ("PEG"), PEG modified with various types of functional groups at the ends of a macromolecular chain, oil, water, alcohols, diethyl sulfate, diisobutyl carbinol, diisobutyl ketone, hexylene glycol, isobutyl acetate, isophorone, isopropyl acetate, methyl isobutyl carbinol, ketone, *n*-butyl acetate, *n*-propyl acetate, primary amyl acetate mixed isomers, primary amyl alcohol mixed isomers, *n*-propyl propionate, *n*-butyl propionate, *n*-pentyl propionate, methylene chloride, perchloroethylene, trichloroethylene, xylene, acetone, ethyl acetate, and chemically related substances.

93. The apparatus as claimed in claim 90, wherein the solvent is an organic solvent.

94. The apparatus as claimed in claim 93, wherein the solvent is polyethylene glycol.

95. The apparatus as claimed in claim 90, wherein the paste-forming vehicle is a paste-forming vehicle system comprising a solute selected from the group consisting of cellulosic resin, thermoplastic resin, glycidyl methacrylate, hydroxy(meth)acrylate monomers, epsilon-caprolactone monomer, hydroxypropyl acrylate, hydroxyethyl acrylate, ethylene acrylic acid, divinylbenzene, styrene-butadiene latexes, acrylic latexes, vinyl acrylic latexes, styrene acrylic latexes, vinyl versatate latexes, vinyl chloride, vinylbenzyl chloride, chloromethylstyrene, vinyl acetate copolymers, epoxy resins, epoxy acrylate, aminoethylethanolamine, glycol ethers, propylene glycols, ethylene glycols, polyols, ethylene acrylic acid resins, methylcellulose, ethyl cellulose, hydroxyethyl cellulose, polyvinyl alcohol, starch, and chemically related substances.

96. The apparatus as claimed in claim 94, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

97. The apparatus as claimed in claim 96, wherein the amount of ethyl cellulose present in the paste is in the range of about 3 to about 5 vol.%.

98. The apparatus as claimed in claim 97, wherein the amount of ethyl cellulose present in the paste is about 3 vol.%.

99. The apparatus as claimed in claim 96, wherein the amount of carbon particles dispersed in the paste is less than about 2 vol.%.

100. The apparatus as claimed in claim 99, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

101. The apparatus as claimed in claim 98, wherein the amount of carbon particles dispersed in the paste is less than about 1.50 vol.%.

102. The apparatus as claimed in claim 101, wherein the amount of carbon particles dispersed in the paste is about 1.25 vol.%.

103. The apparatus as claimed in claim 102, wherein the porous agglomerates of carbon particles comprise a carbon black.

104. The apparatus as claimed in claim 93, wherein the solvent is di(ethylene glycol).

105. The apparatus as claimed in claim 104, wherein the paste-forming vehicle system comprises ethyl cellulose as a solute.

106. The apparatus as claimed in claim 105, wherein the amount of ethyl cellulose present in the paste is about 40 vol.%.

107. The apparatus as claimed in claim 105, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

108. The apparatus as claimed in claim 106, wherein the amount of carbon particles dispersed in the paste is less than about 0.40 vol.%.

109. The apparatus as claimed in claim 108, wherein the amount of carbon particles dispersed in the paste is about 0.20 vol.%.

110. The apparatus as claimed in claim 109, wherein the porous agglomerates of carbon particles comprise a carbon black.